



TITLE:

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THYSANURA HAECKEL
(SCYPHOZOA : RHIZOSTOMAE)

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RECORD OF AN UNUSUALLY LARGE SPECIMEN OF
THYSANOSTOMA THYSANURA HAECKEL
(SCYPHOZOA : RHIZOSTOMAE)¹⁾

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With 5 Text-figures

On November 19, last year, Mr. S. MANABE brought a large brownish medusa into our laboratory aquarium. He found it swimming near the sea surface off Sirahama while he was engaged in fishing that morning. The medusa had been kept alive in an aquarium tank till it was submitted that evening to our examination through the courtesy of Messrs. CH. ARAGA and H. TANASE, curators of the aquarium, to whom we express here our hearty thanks for their generosity to spare this interesting specimen.

At a glance, the general appearance of the medusa reminded us of *Thysanostoma thysanura* HAECKEL. But, the size of the medusa, about 260 mm in umbrella diameter, was so big for this species that we could not convince ourselves of identifying the specimen with that species. After a gross examination was made on the colouration and behaviour and some photographs were taken, the animal was fixed and then preserved in formalin.

Examining the preserved specimen in detail, however, we have come to the conclusion that the medusa is a large fully grown female individual of *T. thysanura*. Nevertheless, the size of its umbrella is beyond the range hitherto known not only for *T. thysanura*, but also for the other two larger species of the genus, *T. flagellatum* (HAECKEL) and *T. loriferum* (EHRENBERG), which are generally accepted as valid species (STIASNY 1940). Some features of the present specimen observed are rather unique. Thus, the description of the present large specimen seems to be significant rather than to be merely the description of an individual and possibly to be helpful to make the specific outline of *T. thysanura* more distinctive. Hence the following description.

Thysanostoma thysanura HAECKEL, 1880

(Figs. 1-5)

1) Contributions from the Seto Marine Biological Laboratory, No. 519.

MAAS (1903), pp. 75-77, pl. 10, figs. 93-94; MEYER (1910), pp. 692-693, fig. 420; KISHINOUE (1910), p. 23; STIASNY (1923), p. 245, fig. 7; STIASNY (1924), p. 493; STIASNY (1929), pp. 202-204, figs. 2-3; UCHIDA (1936), pp. 73-74, fig. 45; STIASNY (1938), p. 26; KRAMP (1961), p. 365.

Thysanostoma denserispum KISHINOUE (1895), pp. 133-136, pl. 18.

While the animal was kept alive, the umbrella was deep dome-shaped and the upper arms were scarcely exposed when the animal postured horizontally (Fig. 1, right). In the preserved state, however, the umbrella becomes flattened roughly to a disc-shape and it is about 260 mm in diameter when the enfolded peripheral zone, 30-33 mm in breadth, is extended and measured together. The disc is superficially about 200 mm across in the intact state in which the peripheral zone is enfolded rather

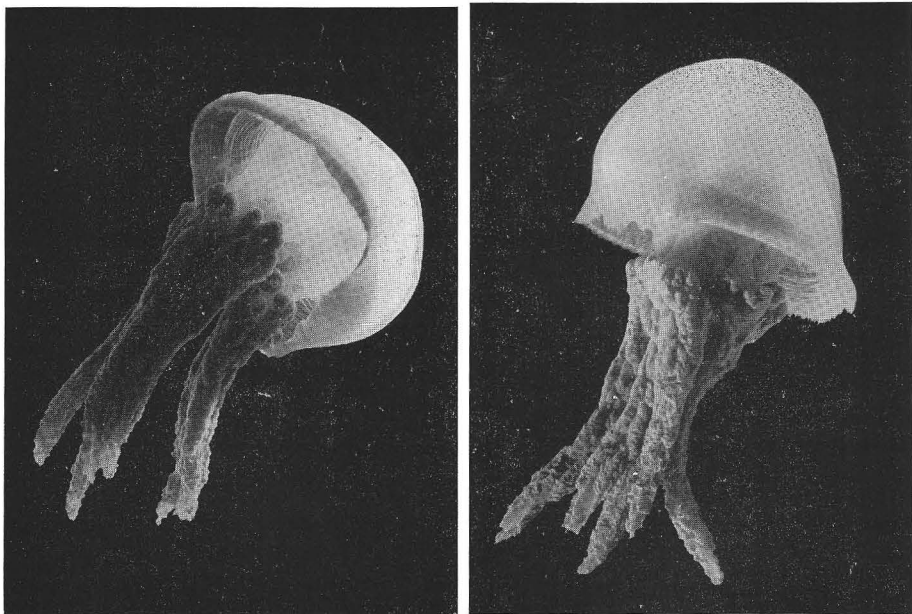


Fig. 1. An unusually large specimen of *Thysanostoma* from Sirahama, swimming in an aquarium tank.

firmly. The mesoglea is about 30 mm thick at the centre of the umbrella and about 4 mm thick along the line about 30 mm apart from the margin, where the peripheral zone is strongly bent off from the disc proper.

The exumbrella is covered almost thoroughly with a fine light brownish network and the surface is rugged by granules formed in meshes of the network. The central area, about 50 mm in diameter, is quite devoid of any granules and smooth, however. Around this smooth central area, the surface is furnished with many small elevations about 1 mm across at the density of up to 20 of such granules per 100 mm². The granules become much smaller towards the periphery, where about 40-60 granules are found in 100 mm², usually two to several granules are gathered in groups. The belt,

10–20 mm in breadth, at the boundary of the peripheral zone and the surface along the bend are nearly smooth. The peripheral zone is again finely granulated, about 100 granules being contained in 100 mm².

The velar lappets are 10 to 12 and most frequently 11 in an octant, between the pair of rhopalar lappets. Twenty-five of the 88 velar lappets are subdivided into a pair of a little smaller lappets. The furrows demarcating respective lappets reach generally 20 mm or a little more from the margin. It is very noteworthy that a much smaller lappet is inserted in every interval between the velar lappets or between the velar lappet and the rhopalar lappet as in *Versura anadyomene* (MAAS) (MAAS 1903, pl. 7, fig. 65; STIASNY 1922, fig. 7). Thus, the lappets are distinctly defined, but they are not prominently protruded out from the margin.

No radial musculature on the subumbrella. The circular musculature is well developed. The circular muscles on the peripheral zone are all entire, coloured brownish, diminishing the thickness towards the periphery, and about 20 in number excluding very fine marginal fibres. About 10 proximal muscles are especially stout, and may be about 1 mm thick. The muscles on the umbrella proper excluding the peripheral zone diminish the thickness towards the centre, and their colour becomes lighter proximally. Generally, they are interrupted narrowly on the interradianal rhopalar canal, but widely on the perradianal rhopalar canal, especially markedly proximally. In the result, 40 to 60 muscles form on the subumbrella four roughly triangular muscle groups which are separated from one another in four perradianal axes. On the interradianal rhopalar canal, about ten distal ones of the muscle group are entire, while the other proximal ones are interrupted for the space 4–5 mm wide, although a few to several ones which are slightly thicker than others are continuous across the space. On the perradianal rhopalar canal, several distal muscles are continuous through fine fibres, while the other proximal ones are interrupted widely; the space becomes bigger proximally to form roughly a large triangle with the top distally. There is a remarkable dark brownish radial colour band on the distal half of respective rhopalar canals, stretching from the rhopalium to the umbrella proper a little beyond the boundary of the peripheral zone. The colour band is 32–33 mm long and 3.5–4.0 mm wide at the maximum near the middle.

The oral disc is roughly quadrate in outline, with a wide depression at the middle of each side, and about 160 mm across the base of the columns opposite in perradianal axis, about 90 mm across the base of the arms opposite in adradial axis, and about 70 mm wide in interradianal axis. One of the perradianal columns is missing, possibly due to a post-natal damage. The columns are about 25 mm thick. The ostia are about 90 mm wide, and the unitary subgenital cavity assumes a low porticus. The thickness of the oral disc is about 40 mm at the base of the perradianal columns, about 20 mm at the base of the oral arms, and about 15 mm at the middle of the ostia. The floor of the subgenital cavity is even and smooth. The underside of the oral disc is furnished with numerous long filaments, the form and arrangement of which are

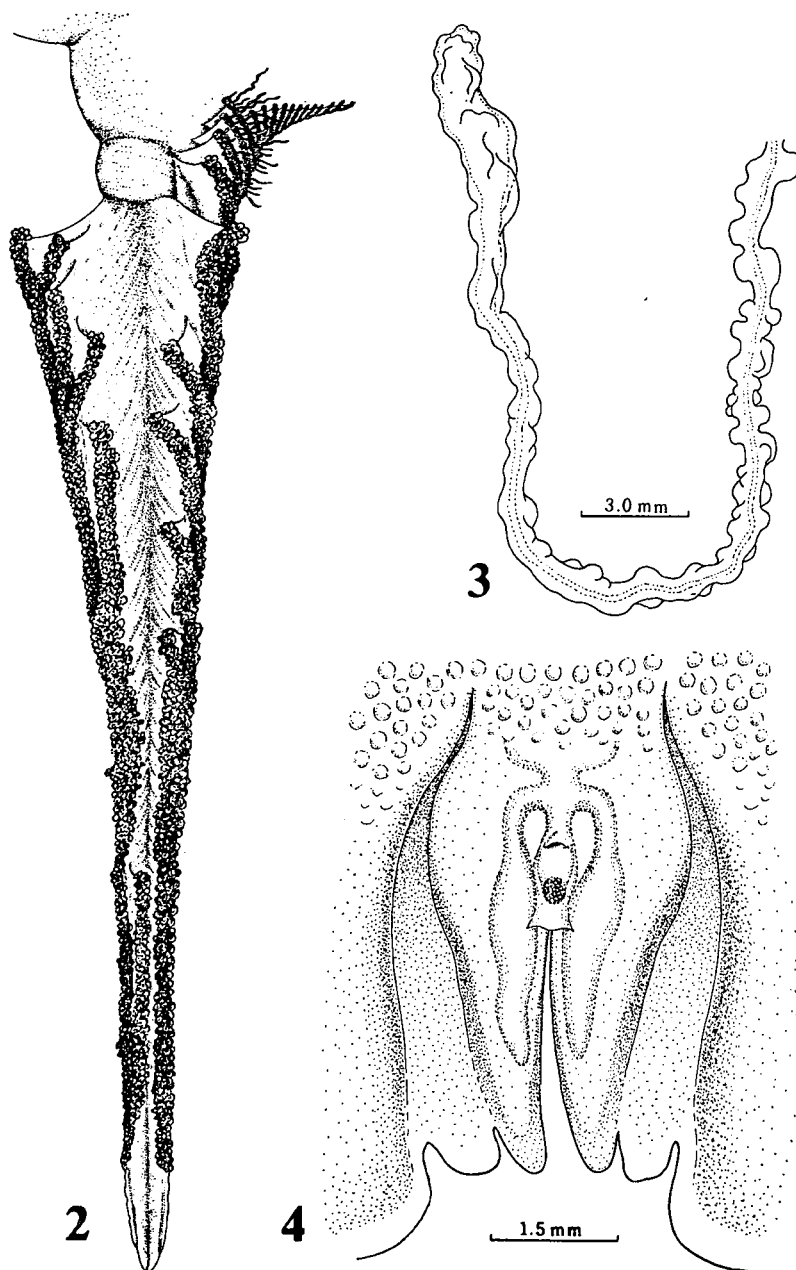


Fig. 2. An oral arm, showing the outer lateral and inner wings of the lower arm, together with their winglets furnished with mouth-frills, and the row of winglets with filamentous appendages on the inner side of the arm base and the underside of the oral disc. Filamentous appendages on the proximal smaller winglets on the underside of the oral disc are omitted.

Fig. 3. A filamentous appendage from a winglet on the inner side of the arm base.

Fig. 4. Rhopalium and rhopalar lappets.

referred to later.

The pair of oral arms subject to the missing perradial column are absent, and thus only 6 oral arms remain on the specimen. They are all nearly in a perfect state, though the small distal portion is abraded (Fig. 2). Lower arms are all tripterous and respectively 160 mm (abraded distal portion, 17 mm), 180 mm (30 mm), 198 mm (20 mm), 205 mm (5 mm), 205 mm (15 mm), and 205 mm (25 mm) in length. The upper arms, which are each constricted off from the 20 mm high triangular arm base, are 10–15 mm long, about 8 mm wide on the outer side, and about 30 mm wide on the lateral side. The inner half of respective lateral sides is seemingly occupied by 4 to 5 winglets, of which the lowest and largest one may be the top winglet of the inner wing of the lower arm and the upper 2 or 3 may belong to the group of winglets formed along the sutures on the underside of the oral disc, as they are each provided with a few filaments. The breadth of the lower arm, when the wings are fully extended, is about 40 mm at the top, 25 mm at the upper quarter, 15 mm at the middle, and about 10 mm throughout the lower third. Outer lateral wings are provided each on respective sides with 6 to 10 winglets which are developed prominently in the upper half and are generally arranged nearly parallel to the wing edge. On the inner wing, the winglets are fewer than on the outer lateral wings, limited in the upper part, and are arranged somewhat perpendicularly to the wing edge. Mouth-frills are formed along the edge of wings and winglets; they are generally brownish in colour, but lighter in the proximal quarter of the inner wing. There are found no kind of appendages among the mouth-frills. The substance of the arm itself is milky white and translucent as that of the oral disc and umbrella, but it becomes slightly brownish in the distal portion of the oral arms. Three pairs of winglets furnished with at least a few to several filamentous appendages are found along the suture on the inner edge of respective arm bases, the lowest one of which may be subject to the upper arm. There are about a dozen more pairs of much smaller winglets along respective sutures on the underside of the oral disc for the distance of about 25 mm. These smaller winglets diminish the size proximally and all are densely beset with numerous long filaments. The filaments (Fig. 3) are variable in size, larger ones attaining 40 mm in length and 1–1.5 mm across in a somewhat shrunken state; they are provided with many small knobs or swells on the surface, especially densely in the proximal portion, and somewhat inflated in the distal portion, ending in a blunt tip. A thin canal passes through the filament to the canal system in the oral disc. The filaments are whitish and the mouth-frills are faintly brownish. The central area, about 5 mm × 12 mm in extent, on the disc is devoid of any winglets and assumes a smooth surface.

The distal naked portion of the oral arms is not always defined very distinctly. As the portion is still evidently tripterous and the axial canal and three wing canals attain the contour surface near the tip, it is clear that the original arm tip is worn off. It is thus quite unknown whether the arm tips of the present specimen were ever

wholly covered with mouth-frills or they were originally naked and with the terminal knob. The connections between the axial canal and the wing canals are seen throughout nearly the whole length of the lower arm.

The canal system in an octant of the umbrella is schematically given in Fig. 5, together with the proximal half of the same in the adjoining octant, which is shown a little enlarged. The ring canal is not thick and is situated just outside the bend bounding the peripheral zone. The meshes of network are in general finer in the peripheral zone than in the umbrella proper. In the peripheral zone, meshes are fine along the ring canal, becomes a little coarser distally and again diminish the size towards the periphery to form an extremely fine peripheral network. Meshes near along the perradial rhopalar canals are generally a little coarser. Rhopalar

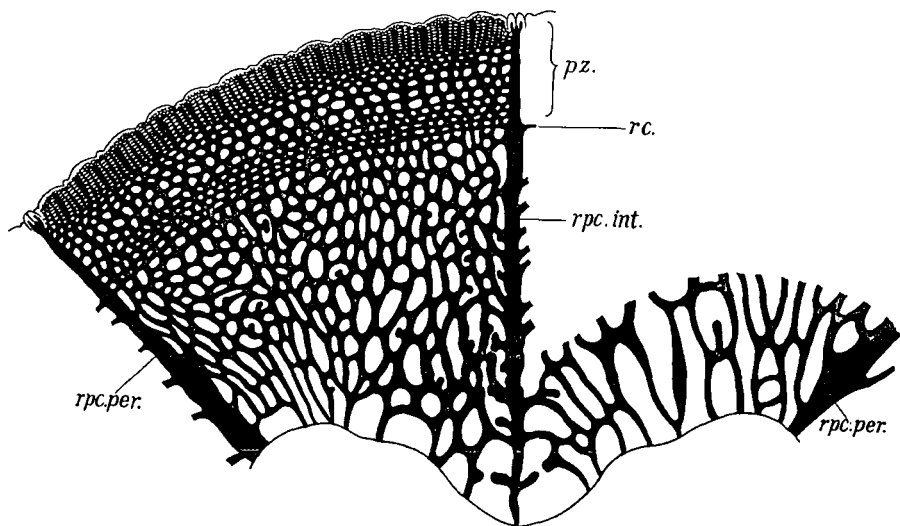


Fig. 5. Anastomosing network of canal system in an octant, together with the canal-roots in an adjoining octant. *pz.*—peripheral zone; *rc.*—ring canal; *rpc.int.*—interradial rhopalar canal; *rpc.per.*—perradial rhopalar canal.

canals are discriminated very easily because of their straight course and remarkable thickness; the perradial rhopalar canal is particularly thick throughout, even near the root, whereas the interradian rhopalar canal becomes thinner near the root. It is somewhat difficult to give exactly the number of canal roots in each octant, though there may be 8 to 10. Meshes of the intracircular canal system are coarser proximally, but they become finer distally so that about 30 canals join the ring canal.

The rhopalium (Fig. 4) is situated deep in the niche between a pair of the rhopalar lappets which are smaller and much slenderer than the velar lappets; the rhopalar and velar lappets are connected with a membrane, the distal end of which is protruded

as a small thin lappet. The statocyst, 0.3 mm in diameter, is roundish and coloured with light orange pigments gathered in a single mass. The hood is slender and about 1.0 mm long. There is a sensory pit on the exumbrella at the proximal part of the hood; no furrows are found on the floor of the pit.

The gonads are yellowish white and are arranged to assume a cruciform mass along the crossed central ridges or the intergenital plates which are 4–5 mm in width. Four arms of the gonadal mass are each 29–38 mm in width and about 65 mm in length from the centre to the distal extremity, with a 20 mm long reflection on the inner surface of the perradial column. The gonad is complicatedly folded to form about 10 larger vesicles on each side of the intergenital plate from the centre to the distal extremity and several smaller ones on the reflection. Ova, round and 0.12 to 0.35 mm in diameter, were found imbedded sparsely below the gonadal epithelium.

Colouration: The colouration given above was observed about three months after the fixation. It is, however, nearly the same as that of the live specimen observed in November, last year. In the live specimen, the gonad was light orange brown and the muscles and mouth-frills were dark chocolate brown, although the latter were lighter proximally on the oral arms.

Remarks: The oral arms have neither filaments nor clubs among the frilled mouths, and their upper arm is much shorter in the present medusa than in *Thysanostoma flagellatum* (HAECKEL, 1880). Moreover, the canal-roots are much fewer and the velar lappets are slightly more in the present medusa than in *T. flagellatum*. Patagium is not developed in the present specimen. For these reasons, the present medusa cannot be confused with *T. flagellatum*, though the comparison of the distal end of the oral arms in a perfect state is impossible here between this species and the present specimen.

In *Thysanostoma loriferum* (EHRENBERG, 1835), the canal-roots in each octant are from about 20 (at least more than ten; STIASNY 1938, p. 27) to about 30 or more. The oral arms are slenderer and their upper arm is somewhat longer, 30 mm in the specimen with the umbrella 180 mm in diameter (STIASNY 1924, p. 494). The velar lappets are 6–8 in each octant, a little fewer than in the present medusa. The ring canal is somewhat thick and the intracircular canal system is fine-meshed as the peripheral canal system outside the ring canal. All these characters combined seem to be enough to separate the present specimen from *T. loriferum*, though the presence or absence of the naked terminal knob at the distal end of the oral arms cannot be confirmed on the present specimen. Thus, the affinity of the present medusa with the two large-sized species of *Thysanostoma* is seemingly negative.

On the contrary, the present medusa conforms rather well to the smallest species of the genus, *T. thysanura* HAECKEL, in many features except for the body size, the appearance of the velar lappets, details of the canal system of the umbrella, and some other characters of less significance. Minor differences in the structure of 3-winged oral arms seem to be of no specific importance, as the structure in question

must be very variable. The oral arms of the present specimen appear comparatively short for *T. thysanura*, but even in this species the oral arms can be much shorter than the umbrella diameter as noted by STIASNY (1929) on a specimen with the umbrella 80 mm wide from Nias Island, in which the oral arms were ± 35 mm in a perfect condition. The filaments under the oral disc are numerous, short, slender, filiform and tubular in appearances; they are 10–15 mm long in the *Albatross* specimen from Mindanao, the Philippines, with the umbrella 100 mm in diameter (MEYER 1910, p. 693). But such filamentous appendages may possibly grow up much more in some larger specimens. The network meshes of the canal system of the umbrella are very fine in the peripheral zone, but they become suddenly coarse in the umbrella proper beyond the ring canal. The anastomosing condition of the canal system in the present specimen may possibly show an ultimate state of the canal system in a fully grown individual of the species. Well-separated state of velar lappets in *T. thysanura* may be possibly but a character of rather small individuals. It has been stated repeatedly that the size of the umbrella is 100–120 mm wide in *T. thysanura*, but here the record of a 160 mm specimen from Tateyama, Japan (KISHINOUE 1910, p. 23) is overlooked. The size of the umbrella of the present specimen is well over the whole records for any species of the genus *Thysanostoma*. However, for the reasons given above, we propose here to treat the present medusa as a fully grown individual of the smallest species. The differences found between the present observation and those hitherto described by many authors may contribute to clear the range of intraspecific variation with the age.

The only suspicion still remaining at a corner of our mind about the present identification is sustained by the description of *Himatostoma loriferum* var. *pacifica* SCHULTZE, 1897 and the notes given on a *Snellius* specimen obtained at Amboina which was identified by STIASNY first with *Lorifera lorifera* but later with *T. thysanura* (STIASNY 1938, p. 26). In the female of *H. loriferum* var. *pacifica*, the thin filaments on the underside of the oral disc are very long, up to 30 mm (SCHULTZE 1897, p. 154). And it is generally accepted as a characteristic of *T. loriferum* that the 6–8 velar lappets in each octant are united by a membrane. The smaller intervening lappets found in the present specimen might have developed from such connecting membranes. The *Snellius* specimen mentioned above is small, well within the size range of *T. thysanura*, and is provided with patagium and with about 20 canal-roots in an octant. The velar lappets are clearly separated, but never united by a membrane. The network meshes of the canal system of the umbrella change suddenly from fine (in the peripheral zone) to coarse (in the umbrella proper) beyond the ring canal (STIASNY 1938, Fig. E). STIASNY considered this specimen as an individual of *T. thysanura* that was transitional between the typical form of this species and *Lorifera lorifera* and provided with the characters of these two species.

The present specimen is deposited in the museum of the Seto Marine Biological Laboratory.

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